CONTRIBUTIONS
FROM THE
CUSHMAN LABORATORY
FOR
FORAMINIFERAL RESEARCH

VOLUME 21, PART 4
December, 1945

Contents

SHARON, MASSACHUSETTS, U. S. A.
1945

CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

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Copies of Volume 21, Part 4, were first mailed December 12, 1945
DORR'S PRINT SHOP, BRIDGEWATER, MASSACHUSETTS, U. S. A.

CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

272. FORAMINIFERA OF THE TYPE LOCALITY OF THE MOODYS MARL MEMBER OF THE JACKSON FORMATION OF MISSISSIPPI

By Joseph A. Cushman and Ruth Todd

The foraminiferal fauna of the Moodys marl member of the Jackson formation is here described and illustrated from its type locality. The Moodys marl is the lowest member of the Jackson formation, underlying the Yazoo clay member, and conformably overlying the Yegua formation, the uppermost formation of the Claiborne group.

Material was collected by Cecil G. Lalicker from two stations: station 1 at the middle, and station 2 near the base. The exact location of the collections is as follows: type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss.

The combined fauna from the two stations has yielded 89 species and varieties, of which 10 are new, plus a few others which have been omitted because they were too poorly represented. Some of the forms recorded here are not sufficiently well preserved or abundant to warrant full identification or description. Of the total number, 44 are common to both stations, 37 are restricted to the middle (station 1) and 8 are restricted to the basal part (station 2). The richer fauna, that from the middle part, includes in general more of the Miliolidae, both in number of species and number of individuals; while the fauna from the basal part includes more of the Polymorphinidae. These are the most striking differences between the faunas from the two stations and they would tend to indicate that the middle part was deposited at shallower depths than the basal part.

The affinities of the fauna are with both the Jackson and Claiborne Eocene, with considerably more of typically Jackson species than of Claiborne species. Notes are given regarding the recorded occurrences of each species. The fauna from the basal part does not seem to have a more strongly Claiborne aspect than the middle part.

The following forms were found:

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

SPIROPLECTAMMINA MISSISSIPPIENSIS (Cushman) (Pl. 13, fig. 1)

Textularia mississippiensis CUSHMAN, U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 90, pl. 14, fig. 4; Prof. Paper 129-F, 1922, p. 125; Prof. Paper 133, 1923, p. 17.—CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 166, pl. 6, figs. 10, 11.—CUSHMAN and THOMAS, Journ. Pal., vol. 3, 1929, p. 177, pl. 23, fig. 1.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 79, pl. 12, fig. 5.—HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 19, pl. 1, fig. 7.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 7, pl. 1, figs. 3, 4.—DAVIS, Journ. Pal., vol. 15, 1941, p. 150, pl. 24, figs. 15-17; pl. 25, figs. 5, 6.—CUSHMAN and SIEGFUS, Trans. San Diego Soc. Nat. Hist., vol. 9, 1942, p. 401, pl. 15, fig. 6.—GOUDKOFF and PORTER, Bull. Amer. Assoc. Petr. Geol., vol. 26, 1942, p. 1653 (list).

Spiroplectammina cf. *mississippiensis* CUSHMAN and APPLIN, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 30, pl. 7, fig. 5.

This species described from the Oligocene Byram marl of Mississippi, is widely recorded in the Eocene and Oligocene. It occurs only at station 1.

SPIROPLECTAMMINA MISSISSIPPIENSIS (Cushman), var. ALABAMENSIS (Cushman) (Pl. 13, fig. 2)

(For references, see these Contributions, vol. 21, 1945, p. 56.)

This species was described from the lower Oligocene Glendon limestone of Alabama and has been recorded from the lower Oligocene of Mississippi and Texas and the upper Eocene of Texas, Mississippi, Alabama, Georgia, and South Carolina. It occurs abundantly at both stations.

Genus TEXTULARIA Defrance, 1824

TEXTULARIA ADALTA Cushman (Pl. 13, figs. 3, 4)

Textularia adalta CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 29, pl. 4, fig. 2; U. S. Geol. Survey Prof. Paper 181, 1935, p. 8, pl. 1, figs. 11, 12.—DAVIS, Journ. Pal., vol. 15, 1941, p. 147, pl. 24, figs. 1, 2.—CUSHMAN and HERRICK, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 57.

This typically Jackson species known from Alabama, Texas, and Georgia, occurs commonly at station 1.

TEXTULARIA cf. DIBOLLENSIS Cushman and Applin (Pl. 13, fig. 5)

A few specimens from station 1 resemble this species described from the upper Eocene of Texas and recorded from Mexico, Alabama, Florida, and Georgia.

Family VALVULINIDAE

Genus KARRERIELLA Cushman, 1933

KARRERIELLA MAURICENSIS Howe and Ellis (Pl. 13, fig. 6)

Karreriella mauricensis HOWE and ELLIS, in HOWE, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 34, pl. 2, figs. 1, 2.

A few specimens from station 1 appear identical with this species from the Cook Mountain formation of the Claiborne Eocene of Louisiana.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

QUINQUELOCULINA LONGIROSTRA d'Orbigny (Pl. 13, fig. 7)

Quinqueloculina longirostra D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 303; Foram. Foss. Bass. Tert. Vienne, 1846, p. 291, pl. 18, figs. 25-27.—PARKER, JONES, and H. B. BRADY, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 251, pl. 8, fig. 8.—FORNASINI, Mem. Accad. Sci. Istit. Bologna, ser. 6, vol. 2, 1905, p. 69, pl. 4, fig. 12.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 12, pl. 2, fig. 16; Special Publ. 13, Cushman Lab. Foram. Res., 1945, pp. 8, 16, pl. 1, figs. 1-8; pl. 3, figs. 1, 3.

A few specimens from station 1 seem, after comparison with topotypes, to belong in this species described from the Pliocene of Castel Arquato, Italy. The surface of the wall is glossy and the edges of the chambers are acute but not keeled.

Quinqueloculina mauricensis Howe from the Cook Mountain formation of Louisiana seems close to this species but is smaller.

QUINQUELOCULINA MOODYSENSIS Cushman and Todd, n. sp. (Pl. 13, fig. 8)

Quinqueloculina laevigata CUSHMAN (not D'ORBIGNY), U. S. Geol. Survey Prof. Paper 181, 1935, p. 11, pl. 2, figs. 13-15.

Test small, about twice as long as broad, periphery rounded; chambers distinct, not inflated; sutures distinct, slightly depressed; wall smooth, polished; aperture terminal, circular, partially filled by a tooth.

Length 0.33-0.60 mm.; breadth 0.20-0.28 mm.; thickness 0.15-0.20 mm.

Holotype (Cushman Coll. No. 45703) from the Eocene, middle part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs frequently at station 1.

This species differs from *Q. harrisi* Howe and Roberts from the Cook Mountain formation of Louisiana in the more elongate and more compressed form and the proportionately smaller aperture. It seems to be the same as that recorded from Jackson, Miss., as "*Q. laevigata* d'Orbigny" referring to the form from the Eocene of the Paris Basin, but, as pointed out by Cushman and McMasters (Journ. Pal., vol. 10, 1936, p. 509), that name is not available, and the species is here described as new.

QUINQUELOCULINA MAURICENSIS Howe, var. LISBONENSIS Cushman and Todd (Pl. 13, figs. 9, 10)

Quinqueloculina mauricensis HOWE, var. *lisbonensis* CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 12, pl. 3, figs. 7, 8.

A few specimens of this variety, described from the Lisbon formation of the Claiborne Eocene in Alabama, occur at station 1.

QUINQUELOCULINA TUBERCULATA Cushman and Todd, n. sp. (Pl. 13, figs. 11, 12)

Test less than twice as long as broad, almost as thick as broad, peri-

phery angled but not keeled; chambers distinct, angled, not inflated, increasing slowly in size; sutures distinct, evenly curved, incised toward the ends of the test, flush in the central portion; wall ornamented with raised knobs arranged in longitudinal rows, in well preserved specimens each knob having a pit on its summit and appearing to be perforated, in eroded specimens the knobs may be worn off leaving only rows of pits and faint longitudinal costae; aperture small, semicircular, without a tooth. Length 0.45-0.70 mm.; breadth 0.35-0.45 mm.; thickness 0.25-0.33 mm.

Holotype (Cushman Coll. No. 45707) from the Eocene, middle part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs commonly at station 1 but no specimens were found at station 2.

This species is very distinctive with its striking raised ornamentation and should be a good index fossil for the Moodys marl.

Genus MASSILINA Schlumberger, 1893

MASSILINA JACKSONENSIS Cushman (Pl. 13, fig. 17)

Massilina jacksonensis CUSHMAN, Journ. Pal., vol. 1, 1927, p. 150, pl. 23, figs. 5, 6; Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 2, pl. 1, fig. 4; U. S. Geol. Survey Prof. Paper 181, 1935, p. 13, pl. 3, figs. 7-10.

A few specimens from station 1 belong in this species described from the Alazan clay of Mexico and recorded from the Jackson formation of Mississippi.

MASSILINA JACKSONENSIS Cushman, var. PUNCTATO-COSTATA Cushman (Pl. 13, fig. 18)

Massilina jacksonensis CUSHMAN, var. *punctato-costata* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 3, pl. 1, figs. 5, 6; U. S. Geol. Survey Prof. Paper 181, 1935, p. 14, pl. 3, figs. 11-13.

The variety occurs at station 1 more commonly than the typical form. It is characterized by curved longitudinal costae in addition to pits. It has been recorded only from the Jackson formation at Jackson, Miss.

Genus SPIROLOCULINA d'Orbigny, 1826

SPIROLOCULINA BIDENTATA Hadley (Pl. 13, fig. 19)

Spiroloculina bidentata HADLEY, Bull. Amer. Pal., vol. 22, No. 74, 1935, p. 5, pl. 1, fig. 4.—CUSHMAN and TODD, Special Publ. 11, Cushman Lab. Foram. Res., 1944, p. 12, pl. 3, figs. 1-6.

Spiroloculina grateloupi CUSHMAN (not D'ORBIGNY), U. S. Geol. Survey Prof. Paper 181, 1935, p. 14, pl. 3, figs. 18-21.

Spiroloculina sp. CUSHMAN, l. c., p. 14, pl. 4, fig. 1.

This species, described from the Moodys marl, occurs commonly at station 1 and rarely at station 2.

Genus ARTICULINA d'Orbigny, 1826

ARTICULINA TERQUEMI Cushman (Pl. 13, fig. 20)

Articulina terquemi CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 3, pl. 1, fig. 7; U. S. Geol. Survey Prof. Paper 181, 1935, p. 14, pl. 4, figs. 2, 3; Special Publ. 10, Cushman Lab. Foram. Res., 1944, p. 6, pl. 1, figs. 16, 17.

This species known only from the Jackson formation of Mississippi occurs frequently at station 1 and rarely at station 2.

Genus MILIOLA Lamarck, 1804

MILIOLA JACKSONENSIS Cushman (Pl. 13, fig. 13)

Miliola jacksonensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 2, pl. 1, figs. 2, 3; U. S. Geol. Survey Prof. Paper 181, 1935, p. 13, pl. 3, figs. 4-6.

Miliola cf. *jacksonensis* FRANKLIN, Journ. Pal., vol. 18, 1944, p. 308, pl. 45, fig. 6.

This Jackson species occurs frequently at station 1. It has been recorded from Mississippi and Alabama and questionably from the lower Oligocene Carapita formation of Venezuela.

MILIOLA SAXORUM Lamarck (Pl. 13, fig. 14)

Miliola (Miliolites) saxorum LAMARCK, Ann. Mus., vol. 5, 1804, p. 352; vol. 9, 1807, pl. 17, fig. 2.—DEFRANCE, Dict. Sci. Nat., vol. 31, 1824, p. 69; vol. 32, 1824, p. 176; Atlas Conch., pl. 15, fig. 1.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 12, pl. 3, figs. 1-3.

Quinqueloculina saxorum D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 301, pl. 16, figs. 10-14.

This species of the Eocene of France has been recorded from the Jackson Eocene of Mississippi. It occurs frequently at station 1 and may be distinguished from *M. jacksonensis* Cushman by its smaller and more numerous pits. All of the specimens found of both species are eroded.

Genus TRILOCULINA d'Orbigny, 1826

TRILOCULINA TRICARINATA d'Orbigny (Pl. 13, fig. 15)

Triloculina tricarinata D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 299; Modèles No. 94, 1826.—REUSS, Sitz. Akad. Wiss. Wien, vol. 55, pt. 1, 1867, p. 71, pl. 2, fig. 4.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 66, pl. 25, figs. 1, 2; text fig. 32; Bull. 103, 1918, p. 82, pl. 32, fig. 2; Publ. 311, Carnegie Instit. Washington, 1919, p. 68, pl. 14, fig. 4; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 454, text figs. 35-37.—PALMER, Bull. Amer. Pal., vol. 10, No. 40, 1923, p. 10, pl. 1, figs. 3, 4.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 6, 1929, p. 56, pl. 13, fig. 3.—HADA, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. 6, 1931, p. 86, text fig. 39.—CUSHMAN, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 59, pl. 13, fig. 3.—PHLEGER, Bull. Geol. Soc. Amer., vol. 50, 1939, p. 1422, pl. 3, fig. 22.—CUSHMAN and HENBEST, U. S. Geol. Survey Prof. Paper 196-A, 1940, pl. 9, fig. 7.—GALLOWAY and HEMINWAY, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Ids., vol. 3, pt. 4, 1941, p. 309, pl. 3, fig. 10.—LEROY, Colorado School Mines Quart., vol. 36, No. 1, pt. 3, 1941, p. 113, pl. 1, figs. 18, 19.—CUSHMAN, Special Publ. 12, Cushman Lab. Foram. Res., 1944, p. 16, pl. 2, fig. 23.

A single specimen from station 1 is referred to this widely recorded species. It is triangular in section and has a large circular aperture, apparently without a tooth.

TRILOCULINA TRIGONULA (Lamarck) (Pl. 13, fig. 16)

Miliolites trigonula LAMARCK, Ann. Mus., vol. 5, 1804, p. 351; vol. 9, 1807, pl. 17, fig. 4.
Triloculina trigonula D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 299, pl. 16, figs. 5-9; Modeles No. 93, 1826.—TERQUEM, Essai Class. Anim. Dunkerque, pt. 2, 1876, p. 81, pl. 11, fig. 2; Mem. Soc. geol. France, ser. 3, vol. 2, 1882, p. 165, pl. 17 (25), fig. 3.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 6, 1917, p. 65, pl. 25, fig. 3; text fig. 31; Bull. 103, 1918, p. 82, pl. 32, fig. 1; Bull. 104, pt. 6, 1929, p. 56, pl. 12, figs. 10, 11; pl. 13, figs. 1, 2.—CUSHMAN and THOMAS, Journ. Pal., vol. 4, 1930, p. 36, pl. 3, fig. 3.—CUSHMAN and VALENTINE, Contr. Dept. Geol., Stanford Univ., vol. 1, No. 1, 1930, p. 16, pl. 4, fig. 7.—HADA, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. 6, 1931, p. 85, text fig. 38.—CUSHMAN and PONTON, Bull. 9, Florida State Geol. Survey, 1932, p. 52, pl. 6, fig. 6.—CUSHMAN, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 56, pl. 13, fig. 1.—ASANO, Saito Ho-on Kai Museum Research Bull. 13, 1937, p. 113, pl. 15, fig. 5.—HOWE, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 39, pl. 3, figs. 1, 2.—LEROY, Colorado School Mines Quart., vol. 36, No. 1, pt. 1, 1941, p. 22, pl. 3, figs. 26-28.—COLOM, Instit. Español Oceanografía, Notas y Resúmenes, ser. 2, No. 108, 1942, p. 22, pl. 4, fig. 76.—CUSHMAN and STAINFORTH, Special Publ. 14, Cushman Lab. Foram. Res., 1945, p. 21, pl. 2, fig. 18.

Two specimens from station 1 are more inflated than the preceding species and have a short bifid tooth in the aperture. This species was described from the Eocene of France and has been widely recorded in the Tertiary and Recent.

Family OPHTHALMIDIIDAE

Genus CORNUSPIRA Schultze, 1854

CORNUSPIRA OLYGOGYRA Hantken (Pl. 13, figs. 23, 24)

Cornuspira olygogyra HANTKEN, Mitth. Jahrb. K. Ungar. geol. Anstalt, vol. 4, 1875 (1881), p. 20, pl. 1, fig. 10.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 15, pl. 4, fig. 14.—CORYELL and EMBICH, Journ. Pal., vol. 11, 1937, p. 293, pl. 41, fig. 15.—HOWE, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 39, pl. 3, figs. 9, 10.
Cornuspira cf. *oligogyra* CUSHMAN and APPLIN, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 32, pl. 7, fig. 9.

Two fragmentary specimens from station 1 are referred to this species described from the Eocene of Hungary and recorded from the Jackson formation of Mississippi, the upper Eocene of Panama, the Cook Mountain formation of Louisiana, and the Yegua formation of Texas.

Genus NODOBACULARIELLA Cushman and Hanzawa, 1937

NODOBACULARIELLA sp. (Pl. 13, figs. 21, 22)

Two specimens from station 1, here figured, probably represent a new species, but description must await additional material.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS cf. ALATO-LIMBATUS (Gümbel) (Pl. 13, fig. 25)

A few specimens from both stations are questionably referred to this species described from the Eocene of Hammer, Germany. In general appearance they resemble topotypes except that they are only about one-sixth as large. The present species has prominent umbones, strongly oblique, curved, and limbate sutures, and not more than 6 chambers in a whorl.

Many different forms from the Eocene and Oligocene have been referred to this species, and probably not all are the same.

Genus PLANULARIA Defrance, 1824

PLANULARIA cf. DANVILLENSIS Howe and Wallace (Pl. 13, figs. 26, 27)

Specimens from both stations have been compared with paratypes, and, except for lacking the peripheral keel, closely resemble this species described from the Jackson Eocene of Louisiana and recorded from the Eocene and Oligocene of Cuba.

PLANULARIA sp. (Pl. 13, fig. 28)

Two specimens from station 2, one of which is figured, appear to be undescribed. They are strongly compressed throughout with a truncate periphery, have limbate sutures of clear shell material, and become rapidly uncoiled. They somewhat resemble *Planularia ouachitaensis* Howe and Wallace but are much smaller.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA FRAGARIA Gümbel, var. TEXASENSIS (Cushman and Applin) (Pl. 13, fig. 29)

Cristellaria fragaria (Gümbel), var. *texasensis* Cushman and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 171, pl. 8, figs. 5-7.

Lenticulina fragaria (Gümbel), var. *texasensis* Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 32, pl. 5, figs. 3-5.

Marginulina fragaria (Gümbel), var. *texasensis* Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 2, fig. 4.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 19, pl. 7, figs. 8-10.—Coryell and Embich, Journ. Pal., vol. 11, 1937, p. 297, pl. 41, fig. 23.

A few specimens from both stations belong in this variety described from Eocene well samples from Texas and recorded from the Jackson formation in Louisiana and Alabama, and the upper Eocene of Panama. The specimens are generally less ornamented than the types, with the beads restricted to the suture lines on the last few chambers.

MARGINULINA MOODYSENSIS Cushman and Todd, n. sp. (Pl. 14, figs. 1, 2)

Test small, elongate, subcylindrical, slightly tapering, periphery lobu-

late; chambers few, distinct, later ones becoming slightly inflated; sutures distinct, depressed, slightly oblique, not limbate; wall ornamented with about 12 longitudinal costae, low and somewhat irregular or oblique, continuous over the early chambers, interrupted by the later sutures, last-formed chamber sometimes smooth; aperture peripheral, radiate, at the end of a protruding neck. Length up to 0.75 mm.; diameter 0.20 mm.

Holotype (Cushman Coll. No. 45742) from the Eocene, middle part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs rarely at both stations.

This species differs from *Marginulina cocoaensis* Cushman from the Jackson formation of Alabama in the more distinct and indented sutures resulting in a lobulated periphery, and in the less prominent costae.

Genus DENTALINA d'Orbigny, 1826

DENTALINA MAURICENSIS Howe and Roberts (Pl. 14, fig. 3)

Dentalina mauricensis Howe and Roberts, in Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 45, pl. 5, fig. 15.

Single fragmentary specimens from both stations seem identical with this species described from the Cook Mountain formation of Louisiana. They are characterized by "longitudinal rows of small elongate pits," and the sutures are horizontal, not oblique.

DENTALINA sp. A (Pl. 14, fig. 4)

A fragmentary specimen from station 1 shows the apertural end of an elongate, slender form with oblique sutures. It seems to be the same as those figured as "*Dentalina filiformis* (d'Orbigny)" from the Jackson

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EXPLANATION OF PLATE 13

All figures × 60 unless otherwise noted.

Fig. 1. *Spiroplectammina mississippiensis* (Cushman). 2. *S. mississippiensis* (Cushman), var. *alabamensis* (Cushman). 3, 4. *Textularia adalta* Cushman. × 40. 5. *T.* cf. *dibollensis* Cushman and Applin. 6. *Karreriella mauricensis* Howe and Ellis. × 40. *a*, front view; *b*, apertural view. 7. *Quinqueloculina longirostra* d'Orbigny. × 40. 8. *Q. moodysensis* Cushman and Todd, n. sp. Holotype. 9, 10. *Q. mauricensis* Howe, var. *lisbonensis* Cushman and Todd. 11, 12. *Q. tuberculata* Cushman and Todd, n. sp. × 40. 11, Paratype. 12, Holotype. *a*, side view; *b*, apertural view. 13. *Miliola jacksonensis* Cushman. × 30. 14. *M. saxorum* Lamarck. × 30. 15. *Triloculina tricarinata* d'Orbigny. × 40. 16. *T. trigonula* (Lamarck). × 40. 17. *Massilina jacksonensis* Cushman. × 40. 18. *M. jacksonensis* Cushman, var. *punctato-costata* Cushman. × 40. 19. *Spiroloculina bidentata* Hadley. × 40. 20. *Articulina terquemi* Cushman. 21, 22. *Nodobaculariella* sp. 23, 24. *Cornuspira olygogyra* Hantken. 25. *Robulus* cf. *alato-limbatus* (Gümbel). 26, 27. *Planularia* cf. *danvillensis* Howe and Wallace. 28. *P.* sp. 29. *Marginulina fragaria* Gümbel, var. *texasensis* (Cushman and Applin).


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formation of Louisiana (Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 25, pl. 6, fig. 2).

DENTALINA sp. B (Pl. 14, fig. 5)

A few incomplete specimens from station 1 show the initial portion of a slightly compressed form with a rounded base, sutures slightly oblique but not depressed, and chambers as broad as high.

Genus NODOSARIA Lamarck, 1812

NODOSARIA EWALDI Reuss (?) (Pl. 14, fig. 6)

A few fragments not more than 3 chambers in length, from both stations, are referred questionably to Reuss' species from the Oligocene of Germany. They have elongate chambers with very slightly depressed sutures. Similar specimens have been recorded from numerous localities in the Eocene to Miocene in America.

Genus LAGENA Walker and Jacob, 1798

LAGENA ACUTICOSTA Reuss (Pl. 14, fig. 8)

The single specimen figured from station 1 was the only one found of this species described from the Cretaceous and widely recorded from Cretaceous to Recent. Similar specimens have been recorded as rare in the Jackson Eocene of Georgia and South Carolina.

Family POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1839

GUTTULINA IRREGULARIS (d'Orbigny) (Pl. 14, fig. 9)

(For references, see these Contributions, vol. 19, 1943, p. 35).—Beck, Journ. Pal., vol. 17, 1943, p. 602, pl. 106, figs. 3, 15.—Cushman and Applin, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 35, pl. 7, fig. 18.—Cushman and Todd, l. c., vol. 21, 1945, p. 14, pl. 3, figs. 20, 21.—Cushman and Herrick, l. c., p. 59, pl. 9, fig. 22.

This species occurs commonly at both stations. It has been widely recorded from Eocene to Miocene.

EXPLANATION OF PLATE 14

All figures × 60 unless otherwise noted.

Figs. 1, 2. *Marginulina moodysensis* Cushman and Todd, n. sp. 1, Holotype. 2, Paratype. 3. *Dentalina mauricensis* Howe and Roberts. 4. *D.* sp. A. 5. *D.* sp. B. 6. *Nodosaria ewaldi* Reuss (?). × 40. 7. *Glandulina ovata* Cushman and Applin. 8. *Lagena acuticosta* Reuss. 9. *Guttulina irregularis* (d'Orbigny). 10. *Globulina inaequalis* Reuss. 11. *Sigmomorphina semitecta* (Reuss), var. *terquemiana* (Fornasini). × 40. 12. *Guttulina spicaeformis* (Roemer). 13. *Globulina gibba* d'Orbigny. × 40. 14. *G. gibba* d'Orbigny, var. *punctata* d'Orbigny. 15. *Sigmomorphina lamarcki* Cushman and Ozawa. × 40. *a*, front view; *b*, apertural view. 16. *Globulina minuta* (Roemer). 17, 18. *Sigmomorphina jacksonensis* (Cushman). 17, × 30. 18, × 40. 19. *S. jacksonensis* (Cushman), var. *costifera* (Cushman). × 40. 20. *Polymorphina frondea* (Cushman). 21. *P. advena* Cushman, var. *nuda* Howe and Roberts. 22, 23. *Camerina jacksonensis* Gravell and Hanna. × 30.

GUTTULINA SPICAEFORMIS (Roemer) (Pl. 14, fig. 12)

Polymorphina spicaeformis ROEMER, Neues. Jahrb. für Min., 1838, p. 386, pl. 3, fig. 31.

Guttulina spicaeformis CUSHMAN and OZAWA, Jap. Journ. Geol. Geogr., vol. 6, 1929, p. 68, pl. 14, figs. 8, 9; Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 31, pl. 5, figs. 1, 2.—ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 7, fig. 3.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 24, pl. 9, fig. 17; pl. 10, figs. 9, 10.—CUSHMAN and HERRICK, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 60, pl. 9, fig. 23.

Guttulina plancii D'ORBIGNY, Voy. Amér. Mérid., vol. 5, pt. 6, "Foraminifères," 1839, p. 60, pl. 1, fig. 5.

Polymorphina uviformis REUSS, Zeitschr. deutsch. geol. Ges., vol. 7, 1855, p. 289, pl. 11, fig. 5.

Polymorphina austriaca D'ORBIGNY, var. *io* CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 174, pl. 9, figs. 6, 7.

Abundant specimens of this species occur at both stations. They may be distinguished from *Guttulina irregularis* (d'Orbigny) by their much more elongate form with the later chambers more separated from one another.

Genus GLOBULINA d'Orbigny, 1839

GLOBULINA GIBBA d'Orbigny (Pl. 14, fig. 13)

Globulina gibba D'ORBIGNY, Ann. Sci. Nat., vol. 7, 1826, p. 266; Modèles No. 63, 1826.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 25, pl. 9, fig. 18; Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 39, pl. 6, fig. 19; Special Publ. 13, 1945, p. 14, pl. 2, fig. 5; Contr., vol. 21, 1945, p. 4, pl. 1, fig. 9.—CUSHMAN and TODD, l. c., p. 14, pl. 3, fig. 22.—CUSHMAN and HERRICK, l. c., p. 60.

This widely occurring species is found commonly at both stations. The above references contain only a few of the many records of this species but the synonymies give further references to most of the other records.

GLOBULINA GIBBA d'Orbigny, var. PUNCTATA d'Orbigny (Pl. 14, fig. 14)

Globulina punctata D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 229, pl. 13, figs. 17, 18.

Globulina gibba D'ORBIGNY, var. *punctata* CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 69, pl. 17, figs. 4, 5.

Polymorphina hirsuta H. B. BRADY, PARKER, and JONES, Trans. Linn. Soc. London, vol. 27, 1870, p. 243, pl. 42, fig. 37.—REUSS, Sitz. Akad. Wiss. Wien, vol. 62, pt. 1, 1870, p. 486, in VON SCHLICHT, Foram. Sept. Pietzpuhl, 1870, pl. 34, figs. 1-3.—JONES and CHAPMAN, Journ. Linn. Soc., Zool., vol. 25, 1896, p. 511, text fig. 21.—JONES, Foram. Crag, pt. 3, 1896, p. 273, pl. 6, fig. 14.—HERON-ALLEN and EARLAND, Journ. Roy. Micr. Soc., 1909, p. 435, pl. 17, fig. 7.—FRANKE, Abhandl. geol.-pal. Inst. Univ. Griefswald, vol. 6, 1925, p. 79, pl. 6, fig. 22.

Globulina rugosa D'ORBIGNY, Foram. Foss. Bass. Tert. Vienne, 1846, p. 229, pl. 13, figs. 19, 20.—TERQUEM, Essai Class. Anim. Dunkerque, pt. 2, 1876, p. 77, pl. 10, fig. 1.

Polymorphina rugosa CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 2, 1923, p. 157, pl. 41, fig. 6.

Polymorphina globosa KARRER (not VON MÜNSTER), Sitz. Akad. Wiss. Wien, vol. 52, pt. 1, 1865, p. 497, pl., fig. 12.

Two specimens from station 2 are the only representatives of this ornamented variety which is widely distributed in Europe from upper Eocene to Recent, but which has not previously been recorded from America.

GLOBULINA INAEQUALIS Reuss (Pl. 14, fig. 10)

Globulina inaequalis REUSS, Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 377, pl. 48, fig. 9.—CUSHMAN, Bull. 4, Florida State Geol. Survey, 1930, p. 35, pl. 5, fig. 22.—CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 73, pl. 18, figs. 2-4.—CUSHMAN and PONTON, Bull. 9, Florida State Geol. Survey, 1932, p. 66, pl. 10, fig. 1.—CUSHMAN and CAHILL, U. S. Geol. Survey Prof. Paper 175-A, 1933, p. 18, pl. 6, figs. 7, 8.—CUSHMAN, Prof. Paper 181, 1935, p. 26, pl. 9, fig. 22.—BERMÚDEZ, Mem. Soc. Cubana Hist. Nat., vol. 12, 1938, p. 11.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 15, 1939, p. 60, pl. 10, fig. 36.—CUSHMAN and MCGLAMERY, U. S. Geol. Survey Prof. Paper 197-B, 1942, p. 68, pl. 4, fig. 33.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 4, pl. 1, fig. 10.

(For additional references, see U. S. Geol. Survey Prof. Paper 181, 1935, p. 26.)

This species occurs frequently at station 1. It may be distinguished from *Guttulina irregularis* (d'Orbigny) in being narrower and more smoothly triangular in section.

GLOBULINA MINUTA (Roemer) (Pl. 14, fig. 16)

Polymorphina minuta ROEMER, Neues Jahrb. für Min., 1838, p. 386, pl. 3, fig. 35.

Globulina minuta CUSHMAN and OZAWA, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 83, pl. 20, figs. 3, 4.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 27, pl. 9, fig. 23.—HOWE, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 54, pl. 7, figs. 15, 16; Journ. Pal., vol. 16, 1942, p. 267 (list).—CUSHMAN and HERRICK, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 60, pl. 10, fig. 2.

(For additional references, see U. S. Geol. Survey Prof. Paper 181, 1935, p. 27).

A single specimen from station 2, here figured, is referred to this species. It is cylindrical and fusiform, with sutures not depressed.

Genus GLANDULINA d'Orbigny, 1826

GLANDULINA OVATA Cushman and Applin (Pl. 14, fig. 7)

Nodosaria (Glandulina) laevigata D'ORBIGNY, var. *ovata* CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 169, pl. 7, figs. 12, 13.—CUSHMAN and G. D. HANNA, Proc. Calif. Acad. Sci., ser. 4, vol. 16, 1927, p. 215, pl. 14, fig. 1.

Pseudoglandulina ovata NUTTALL, Journ. Pal., vol. 6, 1932, p. 16, pl. 3, fig. 13.—PALMER and BERMÚDEZ, Mem. Soc. Cubana Hist. Nat., vol. 10, 1936, p. 275.—CURRAN, Bull. Amer. Assoc. Petr. Geol., vol. 27, 1943, pp. 1378, 1381 (lists).—MARTIN, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, No. 3, 1943, p. 12 (list).—CUSHMAN and STAINFORTH, Special Publ. 14, Cushman Lab. Foram. Res., 1945, p. 27, pl. 14, fig. 1.

Glandulina laevigata (D'ORBIGNY), var. *ovata* ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 2, fig. 6.—CUSHMAN and DUSENBURY, Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 60.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181,

1935, p. 29, pl. 10, figs. 16, 17.—Israelsky, Proc. 6th Pac. Sci. Congress, 1939, p. 576, pl. 6, fig. 7.

Pseudoglandulina laevigata (d'Orbigny), var. *ovata* Cushman and Garrett, Contr. Cushman Lab. Foram. Res., vol. 15, 1939, p. 80, pl. 14, fig. 5.

A few specimens from both stations belong in this species described from the Eocene of Texas and recorded from the Oligocene of Mexico, Cuba, and Trinidad, and the Eocene of California and Alabama.

The specimens are from 1½ to 2 times as long as broad and the initial portion is biserial in all but one specimen, which is megalospheric.

Genus SIGMOMORPHINA Cushman and Ozawa, 1928

SIGMOMORPHINA SEMITECTA (Reuss), var. TERQUEMIANA (Fornasini) (Pl. 14, fig. 11)

(For earlier references, see these Contributions, vol. 19, 1943, p. 37.)

Sigmomorphina semitecta (Reuss), var. *terquemiana* Cushman, Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 24, pl. 4, fig. 15; p. 41, pl. 7, fig. 3.—Cushman and Todd, l. c., vol. 21, 1945, p. 15.—Cushman and Herrick, l. c., p. 61, pl. 10, fig. 4.

A single specimen from station 1 is referred to this species widely recorded in the Eocene.

SIGMOMORPHINA LAMARCKI Cushman and Ozawa (Pl. 14, fig. 15)

Sigmomorphina lamarcki Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 131, pl. 34, fig. 6.

A few specimens from station 2 seem close to the type of this finely ornamented species described from the Eocene, Lutetian, of Campbon, France. The shape of the test is similar to that of *S. semitecta* (Reuss), var. *terquemiana* (Fornasini).

SIGMOMORPHINA JACKSONENSIS (Cushman) (Pl. 14, figs. 17, 18)

Polymorphina jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 35, pl. 5, fig. 5.

Sigmomorphina jacksonensis Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 123, pl. 32, fig. 2.—Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 49, pl. 8, fig. 2.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 28, pl. 10, figs. 1-4.—Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 54, pl. 7, fig. 3.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 4, pl. 1, fig. 12.—Cushman and Herrick, l. c., p. 60, pl. 10, fig. 3.

Polymorphina compressa Nuttall (not d'Orbigny), Quart. Journ. Geol. Soc., vol. 84, 1928, p. 93, pl. 6, figs. 18, 19.

This species occurs frequently at station 2 and rarely at station 1. It is known from the Eocene of Jackson and Claiborne age in the southeastern United States and from the Eocene of Trinidad.

SIGMOMORPHINA JACKSONENSIS (Cushman), var. COSTIFERA (Cushman) (Pl. 14, fig. 19)

Polymorphina jacksonensis Cushman, var. *costifera* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 35.

Sigmomorphina jacksonensis (Cushman), var. *costifera* Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 123, pl. 32, fig. 3.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 7, fig. 1.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 28, pl. 10, figs. 5, 6.—Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 54, pl. 7, fig. 1.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 15, pl. 3, fig. 26.

The variety occurs at both stations and more frequently than the typical form. It also is known from the Eocene of Jackson and Claiborne age of the southeastern United States.

Genus POLYMORPHINA d'Orbigny, 1826

POLYMORPHINA FRONDEA (Cushman) (Pl. 14, fig. 20)

Bolivina frondea Cushman, U. S. Geol. Survey Prof. Paper 129-F, 1922, p. 126, pl. 29, fig. 3; Prof. Paper 133, 1923, p. 20.

Polymorphina frondea Cushman, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 41. —Cushman and Ozawa, Proc. U. S. Nat. Mus., vol. 77, Art. 6, 1930, p. 118, pl. 30, fig. 11.—Bermúdez, Mem. Soc. Cubana Hist. Nat., vol. 12, 1938, p. 20.—Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197-B, 1942, p. 68, pl. 5, figs. 5-7. —Cushman, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 4, pl. 1, fig. 13.

Rare specimens from station 2 belong to this species known from the lower Oligocene of the Gulf Coast region of the United States and from the Eocene of Cuba and the Twiggs clay of Jackson Eocene age of Georgia. The present specimens have a truncate periphery with slightly raised margins.

POLYMORPHINA ADVENA Cushman, var. NUDA Howe and Roberts (Pl. 14, fig. 21)

Polymorphina advena Cushman, var. *nuda* Howe and Roberts, in Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 56, pl. 7, fig. 4.

A single specimen from station 2 appears to belong to this variety described from the Cook Mountain formation of Louisiana. It differs from *Polymorphina frondea* (Cushman) in the shape of chambers becoming much broader toward the apertural end than they do in *P. frondea*, and also in the chambers becoming farther removed from the base as added, resulting in a more acute initial end.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION ADVENUM (Cushman) (Pl. 15, fig. 1)

(For references, see these Contributions, vol. 21, 1945, p. 61.)

This distinctive species of the Oligocene and upper Eocene occurs commonly at both stations. It is characterized by the raised boss over the umbilical region which is made even more prominent by the inner ends of the sutures being excavated.

NONION INEXCAVATUM (Cushman and Applin) (Pl. 15, fig. 3)

(For references, see these Contributions, vol. 21, 1945, p. 62.)

This species occurs at both stations but a little less frequently than *N. advenum* from which it may be distinguished by the inner ends of the sutures being not excavated and the umbilical boss consequently less prominent. Also, the area between the boss and the aperture is covered by a pustulose ornamentation.

NONION PLANATUM Cushman and Thomas (Pl. 15, fig. 2)

Nonion planatum CUSHMAN and THOMAS, Journ. Pal., vol. 4, 1930, p. 37, pl. 3, fig. 5. —CUSHMAN and DUSENBURY, Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 60, pl. 8, fig. 6.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 81, pl. 14, figs. 12, 13. —HOWE, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 58, pl. 7, figs. 24, 25.—CUSHMAN, U. S. Geol. Survey Prof. Paper 191, 1939, p. 4, pl. 1, fig. 15.—HOWE, Journ. Pal., vol. 16, 1942, p. 268 (list).—BECK, Journ. Pal., vol. 17, 1943, p. 603, pl. 107, figs. 12, 13.—CUSHMAN and APPLIN, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 37, pl. 7, fig. 24.—KELLEY, Bull. Amer. Assoc. Petr. Geol., vol. 27, 1943, pp. 8, 11 (lists).—MARTIN, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, No. 3, 1943, p. 11 (list).—BANDY, Journ. Pal., vol. 18, 1944, p. 370, pl. 60, fig. 15.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 15, pl. 3, fig. 29.—CUSHMAN and HERRICK, l. c., p. 61, pl. 10, fig. 8.

This distinctive species with its deep, open umbilicus was described from the Claiborne Eocene of Texas and has been widely recorded in the Eocene of the southeastern United States and California, Oregon, and Washington, with one record from the lower Oligocene Glendon limestone of Alabama. It occurs at both stations, abundantly at station 2.

NONION DANVILLENSE Howe and Wallace (Pl. 15, fig. 4)

Nonion danvillensis HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 51, pl. 9, fig. 3.—CUSHMAN, U. S. Geol. Survey Prof. Paper 191, 1939, p. 5, pl. 1, fig. 19.—HOWE, Journ. Pal., vol. 16, 1942, p. 267 (list).

Typical specimens of this species described from the Jackson Eocene of Louisiana and recorded from the lower Oligocene Glendon formation of Alabama, occur rarely at both stations.

Genus NONIONELLA Cushman, 1926

NONIONELLA HANTKENI (Cushman and Applin), var. SPISSA Cushman (Pl. 15, fig. 5)

(For references, see these Contributions, vol. 21, 1945, p. 63.)

This variety occurs abundantly at both stations. It was described from the upper Eocene Cooper marl of South Carolina and has been recorded from the upper Eocene of Florida, Alabama, Mississippi, and Texas, the Eocene McBean formation of Georgia, and the Oligocene at Choctaw Bluff, Ala.

NONIONELLA HANTKENI (Cushman and Applin), var. FAYETTEI (Cushman and Ellisor) (Pl. 15, fig. 6)

Nonion hantkeni (CUSHMAN and APPLIN), var. *fayettei* CUSHMAN and ELLISOR, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 41, pl. 6, fig. 3.

Nonionella hantkeni (Cushman and Applin), var. *fayettei* Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 7, fig. 9.—Cushman, U. S. Geol. Survey Prof. Paper 191, 1939, p. 30, pl. 8, fig. 6.—Cushman and Applin, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 38, pl. 7, fig. 25.

This variety also occurs abundantly at both stations. Its outline resembles closely that of var. *spissa* but it is much compressed and has a subacute periphery. It has been recorded only from the upper Eocene of Louisiana and Texas.

NONIONELLA JACKSONENSIS Cushman (Pl. 15, fig. 8)

Nonionella jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 10, pl. 1, fig. 23; U. S. Geol. Survey Prof. Paper 181, 1935, p. 31, pl. 12, figs. 3, 4; Prof. Paper 191, 1939, p. 29, pl. 8, fig. 2.—Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 59, pl. 8, figs. 5-7.—Martin, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, No. 3, 1943, p. 11 (list).

Two specimens from station 1 seem identical with the types of this species described from the upper Eocene Ocala limestone in Alabama and known from the Cooper marl of South Carolina, the Cook Mountain formation of Louisiana, and the Lodo formation of California.

NONIONELLA JACKSONENSIS Cushman, var. COMPRESSA Cushman and Todd, n. var.
(Pl. 15, fig. 7)

Variety differing from the typical form in being strongly compressed and with the chambers proportionately longer. Length 0.33 mm.; breadth 0.20 mm.; thickness 0.07 mm.

Holotype of variety (Cushman Coll. No. 45801) from the Eocene, middle part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs rarely at station 1.

Family CAMERINIDAE

Genus CAMERINA Brugière, 1792

CAMERINA JACKSONENSIS Gravell and Hanna (Pl. 14, figs. 22, 23)

Camerina jacksonensis Gravell and Hanna, Journ. Pal., vol. 9, 1935, p. 331, pl. 29, figs. 1-5, 7, 8, 10, 11, 13, 14; Bull. Amer. Assoc. Petr. Geol., vol. 22, 1938, p. 1004, pl. 4, figs. 3, 5, 9.—Cole, Bull. 20, Florida State Geol. Survey, 1942, p. 26, pl. 8, figs. 3-5; Bull. 28, 1945, p. 101, pl. 13, figs. 3-6.

A few slightly broken specimens were found in the material from station 1. They show well the radial beading along the suture lines. This species has been designated as the zone fossil for one of the subsurface zones described by Gravell and Hanna (Bull. Amer. Assoc. Petr. Geol., vol. 22, 1938, p. 1002 ff.) as useful for correlation through Missis-

sippi, Alabama, and Florida and they state that the *Camerina jacksonensis* zone is more or less coextensive with the Moodys marl.

Family HETEROHELICIDAE

Genus GÜMBELINA Egger, 1899

GÜMBELINA VENEZUELANA Nuttall (Pl. 15, fig. 9)

Gümbelina venezuelana NUTTALL, Journ. Pal., vol. 9, 1935, p. 126, pl. 15, figs. 2-4.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 15, 1939, p. 62, pl. 10, figs. 50-53.—MARTIN, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, No. 3, 1943, p. 11 (list).

A single specimen from station 1 seems identical upon comparison with the types of this species from the Eocene of Venezuela. It has also been recorded from the Eocene of a submarine core from off the east coast of the United States and from the Eocene Lodo formation of California.

Family BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

BULIMINELLA ROBERTSI (Howe and Ellis) (Pl. 15, fig. 12)

Bulimina robertsi HOWE and ELLIS, in HOWE, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 63, pl. 8, figs. 32, 33.

Buliminella robertsi MARTIN, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, No. 3, 1943, p. 9 (list).—CUSHMAN and HERRICK, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 64, pl. 10, fig. 15.

Two excellently preserved specimens from station 2 belong in this very small species described from the Cook Mountain formation of Louisiana and recorded from the Eocene Lodo formation of California and McBean formation of Georgia.

Genus ROBERTINA d'Orbigny, 1846

ROBERTINA MOODYSENSIS Cushman and Todd, n. sp. (Pl. 15, figs. 10, 11)

Robertina cf. *angusta* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 8, pl. 2, fig. 5.

Test about 2½ times as long as broad, initial end blunt, apertural end broadly rounded; chambers indistinct, rather low, very gradually increasing in size as added, not inflated; sutures indistinct, not depressed; wall smooth, polished; primary aperture a narrow, curved slit extending about ⅔ the way across the apertural face, secondary aperture fairly large and open at the base of the apertural face. Length 0.35-0.50 mm.; breadth 0.15-0.23 mm.

Holotype (Cushman Coll. No. 45809) from the Eocene, middle part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs frequently at both stations.

This species has already been recorded as "*Robertina* cf. *angusta* (Cushman)" from the Twiggs clay of Jackson Eocene age in Georgia. It differs from *R. angusta* in being much slenderer. It somewhat resembles *Robertina mcguirti* Howe from the Cook Mountain formation of Louisiana but differs from that species in its larger size and much longer aperture.

Genus ENTOSOLENIA Ehrenberg, 1848

ENTOSOLENIA cf. LAEVIGATA (Reuss) (Pl. 15, fig. 28)

Very many forms have been included in this species under the generic names of *Fissurina*, *Lagena*, and *Entosolenia*. The figured specimen from station 1 is the only representative and is a smooth, elongate, and compressed form with a narrow keel and a protruding apertural neck.

ENTOSOLENIA HOWEI Cushman and Todd, n. name (Pl. 15, fig. 29)

Entosolenia orbignyana (Seguenza), var. *elliptica* Howe (not Cushman), Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 64, pl. 9, fig. 14.

The single figured specimen from station 1 seems to be identical with the one figured in the reference above from the Cook Mountain formation of Louisiana. These are entirely different from the types of "*Lagena orbignyana* (Seguenza), var. *elliptica* Cushman" with which they have been compared; being much smaller and having a broad, backwardly-curved lip around the aperture. Length of figured specimen, 0.25 mm.; breadth, including keel, 0.20 mm.; thickness 0.12 mm.

Genus VIRGULINA d'Orbigny, 1826

VIRGULINA DIBOLLENSIS Cushman and Applin (Pl. 15, fig. 13)

Virgulina dibollensis Cushman and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 168, pl. 7, fig. 7.—Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 66, pl. 11, fig. 1.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 21, pl. 3, fig. 14; U. S. Geol. Survey Prof. Paper 181, 1935, p. 36, pl. 14, figs. 1-3; Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 7, pl. 1, figs. 20-22.—Cushman and Todd, Contr., vol. 21, 1945, p. 17, pl. 4, fig. 7.—Cushman and Herrick, l. c., p. 65, pl. 10, fig. 19.

Virgulina cf. *dibollensis* Cushman, Amer. Journ. Sci., vol. 242, 1944, p. 11, pl. 1, fig. 21.

Specimens that seem identical with this species occur rarely at both stations. The types are from the Jackson Eocene but it apparently occurs also in the Claiborne Eocene and similar but not entirely typical specimens are recorded from the Wilcox Eocene.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA JACKSONENSIS Cushman and Applin (Pl. 15, fig. 14)

Bolivina sp. Cushman, U. S. Geol. Survey Prof. Paper 133, 1923, p. 19, pl. 3, fig. 2.

Bolivina jacksonensis Cushman and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 10,

1926, p. 167, pl. 7, figs. 3, 4.—Cole, Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 212.—Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 59, pl. 11, fig. 11.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 3, fig. 3.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 37, pl. 14, figs. 11-13; Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 57, pl. 7, figs. 17, 18.—Galloway and Heminway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Ids., vol. 3, pt. 4, 1941, p. 418, pl. 30, fig. 8.—Cushman and Simonson, Journ. Pal., vol. 18, 1944, p. 198, pl. 32, fig. 15.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 8.

Bolivina cf. *jacksonensis* Cushman and Herrick, l. c., p. 66.

Typical specimens occur commonly at both stations. The species is widely distributed in the upper Eocene and lower Oligocene.

BOLIVINA JACKSONENSIS Cushman and Applin, var. STRIATELLA Cushman and Applin (Pl. 15, fig. 15)

Bolivina jacksonensis Cushman and Applin, var. *striatella* Cushman and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 167, pl. 7, figs. 5, 6.—Cole, Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 212.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 3, fig. 4.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 37, pl. 14, figs. 14-18; Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 58, pl. 7, figs. 19-21; Contr., vol. 21, 1945, p. 8.

The variety occurs abundantly at both stations. From the records it is limited to beds of Jackson Eocene age but widely distributed in Georgia, Alabama, Mississippi, Texas, and Mexico.

BOLIVINA LOUISIANA Howe (Pl. 15, fig. 16)

Bolivina louisiana Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 66, pl. 9, figs. 20, 21.

A single specimen here figured from station 1 seems very close to this species described from the Eocene Cook Mountain formation of Louisiana.

BOLIVINA GRACILIS Cushman and Applin (Pl. 15, fig. 17)

Bolivina gracilis Cushman and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 167, pl. 7, figs. 1, 2.—Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 57.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 37, pl. 14, figs. 8-10; Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 59, pl. 7, figs. 22, 23.—Cushman and Herrick, Contr., vol. 21, 1945, p. 66, pl. 10, fig. 23.

Bolivina cf. *gracilis* Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189-D, 1938, p. 108, pl. 26, figs. 1, 2; Prof. Paper 197-B, 1942, p. 71.

Rather typical specimens of this species occur commonly at station 1. The species is known from the upper Eocene of Georgia, Alabama, Mississippi, Louisiana, and Texas and less typical ones are recorded from the Oligocene of Alabama.

BOLIVINA GRACILIS Cushman and Applin, var. DANVILLENSIS Howe and Wallace (Pl. 15, fig. 18)

Bolivina gracilis Cushman and Applin, var. *danvillensis* Howe and Wallace, Louisiana

Geol. Bull. No. 2, 1932, p. 56, pl. 11, fig. 7.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 59, pl. 7, fig. 24.

A few specimens from both stations seem identical with this variety described from the upper Eocene Jackson formation of Louisiana.

BOLIVINA MOODYSENSIS Cushman and Todd, n. sp. (Pl. 15, figs. 19, 20)

Test small, strongly compressed, gradually increasing in diameter from the rounded initial end to the greatest width formed by the last pair of chambers, periphery acute but not keeled; chambers comparatively few, of uniform shape, increasing very gradually in size as added, not inflated; sutures not depressed, very slightly curved, slightly limbate; wall of the earlier half ornamented with very fine, longitudinal costae, later portion smooth and rather coarsely perforate; aperture a short, narrow opening on the inner margin of the last-formed chamber. Length 0.25-0.30 mm.; breadth 0.15-0.18 mm.; thickness 0.06 mm.

Holotype (Cushman Coll. No. 45829) from the Eocene, middle part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs frequently at station 1 but no specimens were found in the material from station 2.

This species somewhat resembles *Bolivina jacksonensis* Cushman and Applin, var. *striatella* Cushman and Applin but differs in the smaller size, more compressed test, and acute periphery.

BOLIVINA TAYLORI Howe (Pl. 15, fig. 21)

Bolivina taylori Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 67, pl. 9, figs. 9, 10.—Cushman and Applin, Contr. Cushman Lab. Foram. Res., vol. 19, 1943, p. 39, pl. 7, fig. 27.—Cushman and Todd, l. c., vol. 21, 1945, p. 17, pl. 4, fig. 9.

A few specimens from both stations seem very close to this species recorded from the Claiborne Eocene, Cook Mountain formation of Louisiana, Yegua formation of Texas, and Lisbon formation of Alabama. It is quite a distinctive species with its dark limbate sutures of clear shell material.

BOLIVINA ALAZANENSIS Cushman (Pl. 15, fig. 22)

Bolivina alazanensis Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 82, pl. 12, fig. 1; Journ. Pal., vol. 1, 1927, p. 162, pl. 25, fig. 1.—Nuttall, l. c., vol. 6, 1932, p. 20.—Palmer and Bermúdez, Mem. Soc. Cubana Hist. Nat., vol. 10, 1936, p. 290.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 63, pl. 8, figs. 6, 7.—Palmer, Mem. Soc. Cubana Hist. Nat., vol. 14, 1940, p. 298.—Franklin, Journ. Pal., vol. 18, 1944, p. 314, pl. 46, fig. 26.

Bolivina cf. *alazanensis* Cushman and Herrick, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 66.

A few specimens from both stations seem to belong to this species known from the Oligocene Alazan clay of Mexico, the lower Oligocene Carapita formation of Venezuela, the Oligocene of Cuba, and the Jackson Eocene of the southeastern United States. The specimens are comparatively broad and the keeled periphery is slightly serrate.

Genus BITUBULOGENERINA Howe, 1934

BITUBULOGENERINA MOODYSENSIS Cushman and Todd, n. sp. (Pl. 15, figs. 25, 26)

Test stout, about 1½ times as long as wide, early portion rapidly tapering to full width, periphery deeply indented; chambers low, distinct, inflated, later chambers overhanging earlier ones with spinose projections; sutures deeply incised; wall ornamented with coarse, thickset, backwardly projecting spines; aperture set in a depression in the top of the last chamber, surrounded by a narrow but distinct lip, narrowly loop-shaped in the young, elliptical and large in the adult. Length 0.20-0.23 mm.; diameter 0.12-0.18 mm.

Holotype (Cushman Coll. No. 45841) from the Eocene, middle part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs commonly at both stations.

This species differs from *B. eocenica* (Cushman and Ellisor) from well samples of Jackson Eocene age in Texas in the stouter, less tapering, and more indented test, and in the much coarser ornamentation.

EXPLANATION OF PLATE 15

Fig. 3, × 40; all others, × 60.

Fig. 1. *Nonion advenum* (Cushman). 2. *N. planatum* Cushman and Thomas. 3. *N. inexcavatum* (Cushman and Applin). 4. *N. danvillense* Howe and Wallace. 5. *Nonionella hantkeni* (Cushman and Applin), var. *spissa* Cushman. 6. *N. hantkeni* (Cushman and Applin), var. *fayettei* (Cushman and Ellisor). 7. *N. jacksonensis* Cushman, var. *compressa* Cushman and Todd, n. var. Holotype. 8. *N. jacksonensis* Cushman. 9. *Gümbelina venezuelana* Nuttall. 10, 11. *Robertina moodysensis* Cushman and Todd, n. sp. 10, Holotype. 11, Paratype. 12. *Buliminella robertsi* (Howe and Ellis). 13. *Virgulina dibollensis* Cushman and Applin. 14. *Bolivina jacksonensis* Cushman and Applin. 15. *B. jacksonensis* Cushman and Applin, var. *striatella* Cushman and Applin. 16. *B. louisiana* Howe. 17. *B. gracilis* Cushman and Applin. 18. *B. gracilis* Cushman and Applin, var. *danvillensis* Howe and Wallace. 19, 20. *B. moodysensis* Cushman and Todd, n. sp. 19, Holotype. *a*, front view; *b*, apertural view. 20, Paratype. 21. *B. taylori* Howe. 22. *B. alazanensis* Cushman. 23. *Angulogerina ocalana* Cushman. 24. *A. cooperensis* Cushman. 25, 26. *Bitubulogenerina moodysensis* Cushman and Todd, n. sp. 25, Holotype. *a*, front view; *b*, apertural view. 26, Paratype. 27. ***Reussella eocena*** (Cushman). 28. *Entosolenia* cf. *laevigata* (Reuss). 29. *E. howei* Cushman and Todd, n. name. 30, 31. *Discorbis hemisphaerica* Cushman. 30, Dorsal view. 31, Ventral view. 32, 33. *D. globulo-spinosa* Cushman. 32, Dorsal view. 33, Ventral view. 34, 35. *D. assulata* Cushman. 34, Dorsal view. 35, Ventral view.


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Genus REUSSELLA Galloway, 1933

REUSSELLA EOCENA (Cushman) (Pl. 15, fig. 27)

Reussia oecena Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 13, pl. 1, fig. 25.

Reussella eocena Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 38, pl. 15, figs. 4, 5; Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 30, pl. 5, fig. 23.

Reussella rectimargo Cushman (not *Verneuilina rectimargo* Cushman, 1922), U. S. Geol. Survey Prof. Paper 181, 1935, p. 38.

This species occurs abundantly at station 1, but no specimens were found at station 2. The specimens are smaller and much better preserved than the types from the Ocala limestone of Florida and show the sutures clearly.

Genus ANGULOGERINA Cushman, 1927

ANGULOGERINA OCALANA Cushman (Pl. 15, fig. 23)

Angulogerina ocalana Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 14, pl. 1, fig. 30; U. S. Geol. Survey Prof. Paper 181, 1935, p. 41, pl. 16, figs. 7, 8; Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 8, pl. 2, fig. 9.

Numerous specimens from both stations belong to this typically Jackson species which has been widely recorded in the southeastern United States and Mexico.

ANGULOGERINA COOPERENSIS Cushman (Pl. 15, fig. 24)

Angulogerina cooperensis Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 42, pl. 16, fig. 9.—Bermúdez, Mem. Soc. Cubana Hist. Nat., vol. 11, 1937, p. 338.—Galloway and Heminway, New York Acad. Sci., Sci. Survey Porto Rico and Virgin Ids., vol. 3, pt. 4, 1941, p. 436, pl. 34, fig. 13.—Cushman and Herrick, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 66, pl. 10, fig. 28.

This species, in the present material, is restricted to station 1, where it is common. It has been recorded from the Cooper marl of South Carolina, the McBean formation of Georgia, the Eocene of Cuba, and the upper Oligocene Cibao formation of Porto Rico.

EXPLANATION OF PLATE 16

All figures × 60.

Figs. **1, 2.** *Discorbis alveata* Cushman. 1, Dorsal view. 2, Ventral view. **3.** *Eponides jacksonensis* (Cushman and Applin). Ventral view. **4.** *Gyroidina soldanii* d'Orbigny, var. *octocamerata* Cushman and G. D. Hanna. Dorsal view. **5, 6.** *Siphonina danvillensis* Howe and Wallace. 5, Dorsal view. 6, Ventral view. **7, 8.** *Pulvinulinella obtusa* (Burrows and Holland). 7, Dorsal view. 8, Ventral view. **9, 10.** *Cassidulina moodysensis* Cushman and Todd, n. sp. 9, Paratype, ventral view. 10, Holotype, dorsal view. **11, 12.** *Globigerina danvillensis* Howe and Wallace. 11, Ventral view. 12, Dorsal view. **13.** *Globorotalia cocoaensis* Cushman. Oblique view. **14, 15.** *Anomalina bilateralis* Cushman. 14, Ventral view. 15, Dorsal view. **16, 17.** *Cibicides yazooensis* Cushman. 16, Dorsal view. 17, Ventral view. **18, 19.** *C. plano-convexa* Cushman and Todd, n. sp. 18, Paratype, dorsal view. 19, Holotype. *a*, ventral view; *b*, peripheral view. **20.** *C. ouachitaensis* Howe and Wallace. Dorsal view. **21, 22.** *C. americanus* (Cushman), var. *antiquus* (Cushman and Applin). 21, Ventral view. 22, Dorsal view. **23, 24.** *C. lobatulus* (Walker and Jacob). 23, Ventral view. 24, Dorsal view. **25.** *Gypsina globula* (Reuss).

Family ROTALIIDAE

Genus DISCORBIS Lamarck, 1804

DISCORBIS HEMISPHAERICA Cushman (Pl. 15, figs. 30, 31)

Discorbis hemisphaerica Cushman, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 59, pl. 7, fig. 14.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 3, figs. 17, 18.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 43, pl. 16, fig. 13.—Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 73, pl. 10, figs. 16-19.—Cushman and Herrick, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 67, pl. 11, fig. 3.

This distinctive species is not completely involute ventrally with the result that the chambers of the penultimate whorl protrude as small hemispheres on the ventral side, inside the last-formed whorl. It is known from the upper Eocene, McBean formation of Georgia and Jackson formation of Alabama, Mississippi, and Texas. Specimens seemingly identical are recorded by Howe from the Claiborne Cook Mountain formation of Louisiana. Typical specimens occur in both samples but are more abundant at station 2.

DISCORBIS GLOBULO-SPINOSA Cushman (Pl. 15, figs. 32, 33)

Discorbis globulo-spinosa Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 14, pl. 2, fig. 1; U. S. Geol. Survey Prof. Paper 181, 1935, p. 43, pl. 16, fig. 14.—Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 73, pl. 10, figs. 23, 24.

Typical specimens of this well-characterized species occur at both stations but more abundantly at station 2. It is known from the upper Eocene of Jackson age of North Carolina, Alabama, and Mississippi. Howe recorded it from the Claiborne Eocene Cook Mountain formation of Louisiana.

DISCORBIS ASSULATA Cushman (Pl. 15, figs. 34, 35)

Discorbis assulata Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 15, pl. 2, fig. 2; U. S. Geol. Survey Prof. Paper 181, 1935, p. 44, pl. 17, figs. 1, 2.—Cushman and Herrick, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 68, pl. 11, fig. 2.

Rare but typical specimens occur at both stations. It is known from the upper Eocene Ocala limestone of Georgia and Alabama, and McBean formation of Georgia.

DISCORBIS ALVEATA Cushman (Pl. 16, figs. 1, 2)

Discorbis alveata Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 16, pl. 2, fig. 4; U. S. Geol. Survey Prof. Paper 181, 1935, p. 44, pl. 17, fig. 4.

The only previous record for this species is from its type locality in the Jackson formation at Garlands Creek, Miss. Typical specimens occur at station 1.

Genus LAMARCKINA Berthelin, 1881

LAMARCKINA sp.

Two incomplete specimens of a *Lamarckina* were obtained from sta-

tion 1. They do not seem identical with any of the species described from the Tertiary but do not give enough data to warrant a description.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA SOLDANII d'Orbigny, var. OCTOCAMERATA Cushman and G. D. Hanna (Pl. 16, fig. 4)

(For references, see these Contributions, vol. 19, 1943, p. 40.)—Cushman and Herrick, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 69.

Rare specimens of this variety occur in material from both stations. From the records it is widely distributed in the Eocene of America, the Caucasus region, and Australia.

Genus EPONIDES Montfort, 1808

EPONIDES JACKSONENSIS (Cushman and Applin) (Pl. 16, fig. 3)

Pulvinulina jacksonensis Cushman and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 181, pl. 9, figs. 24, 25.

Eponides jacksonensis Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 46, pl. 19, figs. 4-8.—Coryell and Embich, Journ. Pal., vol. 11, 1937, p. 301, pl. 43, fig. 5.—Cole, Florida Dept. Conservation, Geol. Bull. 19, 1941, p. 37, pl. 1, figs. 3, 4.—Applin and Applin, Bull. Amer. Assoc. Petr. Geol., vol. 28, No. 12, 1944, pl. 1, fig. 6.—Applin and Jordan, Journ. Pal., vol. 19, 1945, p. 130 (list).

This species is widely distributed in the upper Eocene of Jackson age in South Carolina, Georgia, Florida, Alabama, Mississippi, and Texas, and is recorded from the upper Eocene of Panama. Typical specimens occur commonly at both stations.

Genus SIPHONINA Reuss, 1850

SIPHONINA DANVILLENSIS Howe and Wallace (Pl. 16, figs. 5, 6)

Siphonina danvillensis Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 70, pl. 13, fig. 1.

Abundant specimens from both stations seem identical with this species described from the upper Eocene of Louisiana. Our specimens have been compared with paratypes and have the same coarsely perforate but smooth and polished wall. This character distinguishes it from *S. jacksonensis* Cushman and Applin which has a reticulate wall.

Family CASSIDULINIDAE

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA OBTUSA (Burrows and Holland) (Pl. 16, figs. 7, 8)

Pulvinulina exigua H. B. Brady, var. *obtusa* Burrows and Holland, Proc. Geol. Assoc., vol. 15, 1897, p. 49, pl. 2, fig. 25.—Plummer, Univ. Texas Bull. 2644, 1926 (1927), p. 151, pl. 11, fig. 2.

Pulvinulinella exigua (H. B. Brady), var. *obtusa* Cushman and Ponton, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 71, pl. 9, fig. 9.

Pulvinulinella obtusa Cushman and Garrett, l. c., vol. 15, 1939, p. 87, pl. 15, figs. 12, 13.—Cushman and Renz, l. c., vol. 18, 1942, p. 11, pl. 2, fig. 16.—Cushman and

Todd, l. c., p. 42, pl. 7, figs. 19, 20.—Cushman, Amer. Journ. Sci., vol. 242, 1944, p. 14, pl. 2, figs. 7, 8; Contr. Cushman Lab. Foram. Res., vol. 20, 1944, p. 27, pl. 4, fig. 32; l. c., p. 46, pl. 7, fig. 29.—Applin and Jordan, Journ. Pal., vol. 19, 1945, p. 132 (list).

A few typical specimens of this species which has been previously recorded only from the Wilcox Eocene and Paleocene, occur at station 1.

Genus CASSIDULINA d'Orbigny, 1826

CASSIDULINA MOODYSENSIS Cushman and Todd, n. sp. (Pl. 16, figs. 9, 10)

Test small, compressed, equally biconvex, periphery entire, acute but not angled or keeled; chambers distinct, 4 or 5 pairs in the last whorl; sutures distinct, curved, slightly depressed; wall smooth, polished; aperture a comparatively broad, elongate opening at the base of the last-formed chamber. Diameter 0.17-0.23 mm.; thickness 0.12-0.15 mm.

Holotype (Cushman Coll. No. 45875) from the Eocene, basal part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. It occurs rarely at both stations.

This species differs from *Cassidulina laevigata* d'Orbigny in its very small size and proportionately less compressed test.

Family GLOBIGERINIDAE

Genus GLOBIGERINA d'Orbigny, 1826

GLOBIGERINA DANVILLENSIS Howe and Wallace (Pl. 16, figs. 11, 12)

Globigerina danvillensis Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 74, pl. 10, fig. 9.

"Test small, trochoid but nearly planispiral, periphery lobate; chambers few, about eight visible on the dorsal side, about four in the last-formed whorl, almost spherical in shape; sutures depressed; wall calcareous, finely spinose, perforate; aperture an almost circular opening on the ventral side not quite centered on the periphery. Diameter 0.2 mm.; diameter of largest chamber 0.13 mm."—Howe and Wallace.

Numerous specimens from both stations fit the above description of this species from the Jackson formation of Alabama. Our specimens are slightly larger, averaging 0.27 mm. in diameter.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA COCOAENSIS Cushman (Pl. 16, fig. 13)

Globorotalia cocoaensis Cushman, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 75, pl. 10, fig. 3.—Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 75, pl. 14, fig. 4.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 4, fig. 6.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 50, pl. 21, figs. 1-3.—

Coryell and Embich, Journ. Pal., vol. 11, 1937, p. 301, pl. 43, fig. 11.—Thalmann, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, No. 1, 1942, p. 9 (list).—Cushman and Herrick, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 71, pl. 11, fig. 13.

A single typical specimen from station 2 is figured.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA BILATERALIS Cushman (Pl. 16, figs. 14, 15)

Anomalina bilateralis Cushman, U. S. Geol. Survey Prof. Paper 129-E, 1922, p. 97, pl. 21, figs. 1, 2; Prof. Paper 129-F, 1922, p. 137; Prof. Paper 133, 1923, p. 42.—Howe, Journ. Pal., vol. 2, 1928, p. 174 (list).—Cole and Ponton, Bull. 5, Florida State Geol. Survey, 1930, p. 46, pl. 10, figs. 8, 9.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 4, figs. 7, 9.—Cushman, U. S. Geol. Survey Prof. Paper 181, 1935, p. 50, pl. 21, figs. 4, 5.—Bermúdez, Mem. Soc. Cubana Hist. Nat., vol. 11, 1937, p. 339.—Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 197-B, 1942, p. 75.—Howe, Journ. Pal., vol. 16, 1942, p. 267 (list).

This species is chiefly one of the lower Oligocene, being recorded in the Byram marl, Mint Spring marl, and Red Bluff clay of Mississippi, the Marianna limestone of Florida, the Vicksburg group of Texas, the Chickasawhay marl and Glendon formation of Alabama. It has also been recorded in beds of Jackson Eocene age in Texas, Mississippi, Alabama, and Georgia, and in the Eocene of Cuba.

Our specimens have been compared with the types and seem identical. It occurs fairly commonly at both stations.

Genus CIBICIDES Montfort, 1808

CIBICIDES MAURICENSIS Howe and Roberts

Cibicides mauricensis Howe and Roberts, in Howe, Geol. Bull. 14, Louisiana Geol. Survey, 1939, p. 87, pl. 13, figs. 4, 5.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 21, 1945, p. 20.

"Test plano-convex, the dorsal side even slightly concave in some specimens, ventral side evenly convex, periphery subacute; chambers about 10 in number, regularly increasing in size; sutures distinct, dorsally limbate; wall smooth, perforate; the central area on the dorsal side occupied by a clear boss, around which are minor granulations, the clear central boss appears to extend completely through the test to the ventral side where it occupies the area between the chambers; aperture peripheral and extending to the dorsal side along the base of the last three chambers. Length, 0.30 mm.; breadth, 0.23 mm.; thickness, 0.13 mm."—Howe and Roberts.

This species occurs frequently and in typical form at both stations. It was described from the Claiborne Eocene Cook Mountain formation

of Louisiana and has been recorded from the Lisbon formation, also of Claiborne age, in Alabama.

CIBICIDES YAZOOENSIS Cushman (Pl. 16, figs. 16, 17)

Cibicides yazooensis CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 59, pl. 7, fig. 12.—ELLISOR, Bull. Amer. Assoc. Petr. Geol., vol. 17, No. 11, 1933, pl. 5, figs. 2, 5.—CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 53, pl. 23, fig. 2.

Typical specimens of this Jackson species occur frequently at both stations. It is known from Mississippi, Alabama, and Texas.

CIBICIDES AMERICANUS (Cushman), var. ANTIQUUS (Cushman and Applin) (Pl. 16, figs. 21, 22)

Truncatulina americana CUSHMAN, var. *antiqua* CUSHMAN and APPLIN, Bull. Amer. Assoc. Petr. Geol., vol. 10, 1926, p. 179, pl. 9, figs. 12, 13.

Cibicides americanus (CUSHMAN), var. *antiquus* CUSHMAN, U. S. Geol. Survey Prof. Paper 181, 1935, p. 53, pl. 22, figs. 1, 2.

This variety is known from the Jackson Eocene of South Carolina, Alabama, Mississippi, and Texas. It is present in material from both stations but less common at station 2.

CIBICIDES PLANO-CONVEXA Cushman and Todd, n. sp. (Pl. 16, figs. 18, 19)

Test plano-convex, dorsal side flattened or even slightly concave, ventral side strongly convex, periphery acute, slightly keeled; chambers distinct, 8 to 10 in the adult whorl, increasing very gradually in size as added, slightly inflated on the ventral side, periphery of the chambers with a distinct, broad keel; sutures distinct, strongly curved; wall coarsely perforate except the keeled periphery which is smooth; aperture at the periphery and extending over onto the dorsal side beneath the keel of the inner margin of the last-formed chamber. Diameter 0.30-0.40 mm.; thickness 0.15-0.18 mm.

Holotype (Cushman Coll. No. 45895) from the Eocene, basal part of the Moodys marl member of the Jackson formation, type locality on E. bank of Moody's Branch 250 feet upstream from bridge across Moody's Branch on Monroe Street, NE. part of Jackson, Miss. The species is abundant at both stations.

This species differs from *Cibicides westi* Howe in the lesser convexity of the ventral side, more acute periphery, coarse perforations of the test, and the broad peripheral keels of the chambers.

CIBICIDES OUACHITAENSIS Howe and Wallace (Pl. 16, fig. 20)

Cibicides ouachitaensis HOWE and WALLACE, Louisiana Geol. Bull. No. 2, 1932, p. 78, pl. 14, fig. 6.

Rare specimens of this species occur at station 1 only. The types are from the Jackson formation at Danville Landing, Louisiana.

CIBICIDES LOBATULUS (Walker and Jacob) (Pl. 16, figs. 23, 24)

Specimens similar to the Eocene ones which have been referred to this species occur at both stations. This specific name has been widely used and probably more than one species is included.

Family PLANORBULINIDAE

Genus GYPSINA Carter, 1877

GYPSINA GLOBULA (Reuss) (Pl. 16, fig. 25)

This species has been widely recorded fossil and Recent. It is common in the Jackson Eocene of Mississippi and especially in the Ocala limestone of Georgia, Florida, and Alabama. Specimens were found only at station 1.

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the foraminifera that have come to hand:

van Bellen, R. C. Some eocene Foraminifera from the neighbourhood of Ricice near Imotski, E. Dalmatia, Yugoslavia.—Proc. Ned. Akad. v. Wetensch., Amsterdam, vol. XLIV, No. 8, 1941, pp. 1-12, pl., table.—Lists many foraminifera with stratigraphic ranges. Numerous species are figured, the following new: *Gaudryina eocanica* n. sp., *Plectina sphaerica* n. sp., *Dentalina bohemiensis* n. sp., *Valvulineria wittpuyti* n. sp., *Anomalina tenuissima* (Reuss), var. *evoluta* n. var., *A. dalmatina* n. sp., *Cibicides dalmatina* n. name, *C. keijzeri* n. sp., *C. dorsmani* n. sp. A new genus related to *Ceratobulimina* is erected, *Roglicia* (genoholotype *R. sphaerica* n. sp.).

van Bellen, R. C., J. F. C. de Witt Puyt, A. C. Rutgers, and J. van Soest. Smaller Foraminifera from the Lower Oligocene of Cuba.—L. c., No. 9, 1941, pp. 1-8, pl., table.—One hundred forty species and varieties of foraminifera are listed and their ranges given. A number of species are figured, the following new: *Planularia brandsi* de Witt Puyt, n. sp.; *P. thiadensi* de Witt Puyt, n. sp.; *Pullenia sphaeroides* d'Orbigny, var. *cubensis* de Witt Puyt, n. var.; *Eponides tschoppi* van Bellen, n. sp.; *Rotalia cubensis* van Bellen, n. sp.; *Siphonina cubensis* van Bellen, n. sp.; *Pulvinulinella cubensis* van Bellen, n. sp.; *Anomalina cubensis* van Bellen, n. sp.; *Planulina palmerae* van Bellen, n. sp.; *Cibicides cubensis* van Bellen, n. sp.; *C. tschoppi* van Bellen, n. sp.

Glaessner, M. F. Mesozoic Fossils from the Central Highlands of New Guinea.—Proc. Roy. Soc. Victoria, vol. LVI, pt. II (new series), June 30, 1945, pp. 151-168, pl. VI.—Lists numerous species of foraminifera.

Parr, W. J. Recent Foraminifera from Barwon Heads, Victoria.—Proc. Roy. Soc. Victoria, vol. 56 (n. ser.), pt. 2, June 30, 1945, pp. 189-227, pls. VIII-XII, figs. 1, 2 (maps).—There are 142 species and varieties recorded, including 13 new.

Cooke, C. Wythe. Geology of Florida.—Florida Geol. Survey, Geol. Bull. 29, 1945 pp. 1-339, 47 figs., maps.—A number of foraminifera are mentioned.

Thompson, M. L. Pennsylvanian Rocks and Fusulines of East Utah and Northwest Colorado Correlated with Kansas Section.—State Geol. Survey of Kansas, Bulletin 60, 1945 Reports of Studies, Pt. 2, Oct. 15, 1945, pp. 17-84, pls. 1-6, figs. 1-11.—A number of species are described and figured, the following new: *Millerella inflecta* n. sp., *M. circuli* n. sp., *Fusulinella iowensis,* var. *leyi* n. var., *F. uintaensis* n. sp., *F. lounsberyi* n. sp., *F. haywardi* n. sp., *Wedekindellina matura* n. sp., *Fusulina prima* n. sp., *F. pristina* n. sp., *F. curta* n. sp.

Keijzer, F. G. Outline of the Geology of the Eastern Part of the Province of Oriente, Cuba (E of 76° WL) with Notes on the Geology of other Parts of the Island. Oct. 1, 1945, pp. 1-238, pls. I-XI, figs. 1-34, map.—Many lists of foraminifera are given and in the systematic portion 26 new species and 8 new varieties are described. In addition, a new subfamily Rhapydionininae of the Peneropliidae is given. Several new genera are erected: *Pseudogoësella* n. gen. (genotype *P. cubana* n. sp.), *Taberina* n. gen. (genotype *T. cubana* n. sp.), *Kelyphistoma* n. gen. (genotype *Pseudorbitolina cubensis* Cushman and Bermúdez). Also a new subgenus of *Frondicularia, Annulofrondicularia,* is named.

Cushman, Joseph A. and **Ruth Todd.** Miocene Foraminifera from Buff Bay, Jamaica. Special Publ. No. 15, Cushman Lab. Foram. Res., Oct. 13, 1945, 85 pp., 12 pls.—From this rich foraminiferal fauna 243 species and varieties are recorded including 24 new species and 8 new varieties.

J. A. C.

gen. (genotype *K. ampulloloculata* n. sp.), *Tschoppina* n.